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ABSTRACT

The bibliography lists 90 mathematics lessons considered appropriate for mildly handicapped and non-handicapped elementary students using PLATO, a large-scale computer-based education system. Brief introductory remarks describe the rationale for computer assisted instruction, review the development of the PLATO system, and summarize findings of its application with handicapped students, including children with severe and profound developmental disabilities and hearing impairments. The bibliography, developed to help classroom teachers and curriculum coordinators considering the adoption of PLATO resources, lists reading level and difficulty of student instructions along with the name and file name of the lesson. (CL)

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The PLATO Mathematics Curriculum: An Annotated Bibliography for use with Mildly Handicapped Students

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Introduction

Suran and Rizzo (1983) reported 3 percent of the population of school-age students to be mentally retarded-- a total of 1,650,000 students. They further reported 2.5 percent of school-age students to be learning disabled--1,375,000 students. Together, students in these two exceptionalities comprise 5.5 percent in a total of 19.85 percent for all areas of handicapped children served in the nation (3,025,000 out of a total of 10,916,555 children). These figures graphically point out that school-age students who are educable mentally retarded and learning disabled comprise one-third of the total number of handicapped children served in the nation's schools. Educational service for the educable mentally retardded and the learning disabled student can make the difference in their becoming self-reliant, contributing members of society rather than members financially dependent on society.

RAtionale

According to Blaske (1982), widespread application of the use of technology with the handicapped could accomplish a great deal and should be investigated. Benefits and advantages of computer-assisted instructional technology with handicapped children have been reported by many researchers. The advantages are to (a) present routine skill training in an attractive format that minimizes extraneous distractions, (b) provide for individual differences, (c) extend the ability of schools to monitor the student's educational progress, (d) teach, instruct or provide practice on equipment that can be used without such close supervision, (e) use more than one sense in the learning process by way of a touch-sensitive terminal screen,

(f) provide an opportunity for assessing eye-hand coordination and teaching sight recognition of basic word vocabulary by use of the button box, (g) maintain statistics on student performance in a lesson, (h) allow pictorial displays, (i) allow detailed teacher-prescribed assignments, (j) allow automatic adjustment of lesson difficulty for individual performance, and (k) provide a vehicle whereby a handicapped child can, at an early age, involve himself in activities with technology and demonstrate skills thought to be beyond his or her ability by more traditional approaches (Dugdale, & Vogel, 1978; Geoffrion & Goldenberg, 1981; Macleod & Overheu, 1977: Naiman, 1983; and Stallard, 1982). In addition, subjective behavioral benefits have been demonstrated by the improved attitude of the handicapped students towards themselves and their peers who have been designated to proctor (Sandals, 1979). Finally, Lance (1977) maintained that if a truly appropriate education is to be provided for each child, teachers must be supported by a technology that will permit them to deal with a vast range of individual differences.

The PLATO System

PLATO is a large-scale computer-based education system developed at the Computer-Based Education Research Laboratory (CERL) at the University of Illinois in collaboration with the National Science Foundation and Control Data Corporation. PLATO has the ability to provide every benefit previously listed plus the ability to provide animated displays that aid in concept development. In addition, PLATO has demonstrated its ability to provide uniformly high-quality education and it responds to a student's needs in a way heretofore not possible in a typical classroom environment (Norris, 1983). The system can accommodate many users at the same time regardless of learning level or subjects being studied due to its mainframe format.

PLATO also has extensive record-keeping capabilities that will free the teachers from many routine administrative tasks allowing them to concentrate on the provision of personal guidance and support. Additionally, PLATO allows easy individualization of instruction. Cook and Leffingwell (1982) reported that the traditionally high demands for individualized lesson presentation as well as the lack of materials and equipment specifically designed to facilitate P.L. 94-142 mandates led to a high degree of stress among special education teachers. They stated, "School districts that provide special educators with valid, prescriptive materials and equipment will be well on the way to reducing one stress variable, and will upgrade the services that are extended to handicapped pupils (p. 56)."

Further, PLATO has demonstrated its ability to successfully instruct handicapped children. Siegel and Clapp (1981) conducted a two-year project investigating the use of PLATO for the severely and profoundly developmentally disabled child. They considered the viability, attractiveness, and effectiveness of PLATO with 225 students and adults. Over 100 instructional formats were developed by staff from the PLATO Education Group of the Computer-Based Education Research Laboratory (CERL) at the University of Illinois, Urbana-Champaign. The skills addressed included basic language and mathematics skills. Results suggest that carefully designed PLATO materials can provide effective and efficient instructional services not now offered by other media.

Dugdale and Vogel (1978) investigated the use of PLATO with aurally handicapped children in a pilot trial for mathematics. The major instructional materials used with the hearing-impaired students were the intermediate-level mathematics PLATO curriculum developed at CERL. This pilot trial

proved conclusively that PLATO could be adapted easily for use with these handicapped students without large changes in either courseware or software systems. Results had positive implications for educating the hearing impaired at all age levels from third grade through adults. Even though successive studies with the handicapped have been reported using PLATO, no research appears to have been conducted using PLATO with the educable mentally retarded or learning disabled student.

An Annotated Bibliography

The PLATO Mathematics Project contains a sequence of lessons designed for elementary school students. Many of the lessons appear suitable in content for use in special education for mild handicapped students as well with minimal or no modifications. To this end, an annotated bibliography was developed as a resource guide for the use of classroom teachers and curriculum coordinators in special education who may be considering the adoption of PLATO resources for this population. Of particular interest was the notation of the reading level and difficulty or complexity of the presentation of instructions presented to the student. The evaluation of curricular material before purchase of the system or its extended use with the special education population may save time, money, and frustration. Since this information is not available from the system producers, the development and circulation of annotated computer program wares may hasten the implementation of appropriate and effective computer-assisted instruction for the mildly handicapped student.

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PLATO MATHEMATICS CURRICULUM
ANNOTATED BIBLIOGRAPHY

1. Add & Subtract With Equivalence Sets PMP
   Filename: ØSLAD2
   Upper intermediate reading level

2. Addition and Subtraction PMP
   Filename: ØTRYAD
   - A. Like denominators (easy upper elementary, must know times tables)
   - B. Unlike denominators (harder than above)
   - C. 2 + 1/2 = 2 1/2

3. Addition Practice, Simplifying Answers PMP
   Filename: ØPAD1
   - A. Add and subtract mixed numbers (easy, shows diagrams)
   - B. Simplifying answers to addition problems (4th, 5th)
   - C. Standard form practice (requires reading upper elem.)
   - D. Addition practice (4,5) no reading simplifying answers
   - E. Standard form checkup (4,5) no reading, change fractions to mixed numbers

4. Addition With Equivalence PMP
   Filename: ØSLAD
   - A. Requires reading upper elem. or inter. Helps students to learn to find like denominators. High 3rd or 4th grade reading level

5. Ant Hill
   Filename: ØANTS
   High 3rd math and reading
   - A. Introduction and practice on more and less (3rd grade reading level required, 3rd grade math)
   - B. Introduction to the number sentence (4-6=-2) (3rd grade reading required, 3rd math)
   - C. Practice writing an entire number sentence (4-3=1) (3rd grade reading required, 3rd grade math)
   - D. Checkup (without ants) on adding and subtracting negatives and positives (3-7=-4)

6. Beehive
   Filename: ØBEES
   - A. 2nd grade reading and math, using graphic display for counting

7. Boxes
   Filename: ØRECEQA
   - A. 3rd grade reading, 3rd grade math
   - B. Shades box to show which is painted (1/2)

8. Boxes: Equivalent Fraction Practice PMP
   Filename: ØRECEQB
   A. Boxes: Equivalent fractions practice (lesson)
      4th grade reading and above
   B. Checkup: Boxes -- equivalent fractions
      4th grade reading and above

9. Boxes: How Much is Painted?
   Filename: ØRECOLSK
   A. 3rd grade reading, 4th math PMP

10. Boxes: Name Equivalent Fractions PMP
    Filename: ØRECHAMS
    A. 3rd to 4th grade reading and math
    B. Explains with coloring boxes

11. Candy Factory
    Filename: ØCANDY
    A. 1st or 2nd grade math, no reading
    B. Counting to know full from empty
    C. Filling box with candy and leading it on truck in a sequence
    D. Sight vocabulary sufficient

12. Candy Warehouse
    Filename: ØCANDYWH
    A. 1st or 2nd grade, no reading, sight word
    B. Moving bundles with the touch panel

13. Checkup: Cut and Paint PMP
    Filename: ØRECCHK
    A. 3rd to 4th grade reading, fractions

14. Checkup: Cut and Paint
    Filename: ØGRINTERCEPTS
    Difficulty level: too difficult for middle school EMR
    1. Shape of linear graphs (pre-algebra)
    2. Intercept of linear graphs (pre-algebra) slopes

15. Checkup: Pizza Fractions PMP
    Filename: ØPCHK
    About 3rd to 4th grade reading, 4th math

16. Checkup: Plotting Points
    Filename: ØTTTCKP
    About intermediate elem. reading, math intermediate
    A. Plotting lines on a graph

17. Counting Practice
    Filename: ØNEWCOUNT
    Primary reading level
    A. Counting forwards and backwards

18. Cut and Paint and Fraction Notation PMP
    Filename: ØREC
    About 3rd grade reading
        A. Good diagrams

19. Darts MP
    Filename: ØDARTS
    High 2nd to 3rd grade reading
        1. Darts lesson
        2. Darts checkup
        3. Excellent to help students learn the number line concept can have negative numbers if desired
        4. Not much reading

20. Decimal Darts PMP
    Filename: ØDDARTS
    3rd grade reading level
        A. Same as above except with decimals -- three parts
            1. Decimal parts 1 (intro)
            2. Decimal parts 2
            3. Decimal parts checkup
        B. Not much reading

21. Decimal Names for Fraction Names
    Filename: ØCON
        1. Decimal names for fractions
        2. Fraction names for decimal numbers
        3. Checkup: decimal and fraction conversions

22. Decimal Pinball PMP
    Filename: ØPIND
    3rd grade reading, only 3 sentences to read
        A. Changes fractions to decimals

23. Equivalent Experience PMP
    Filename: ØSTERMSX
    3rd to 4th grade reading level

24. Equivalent Fractions Generalized PMP
    Filename: ØEGEN
    3rd grade reading level
        1. Equivalent fractions generalized (lesson)
        2. Checkup: Equivalent fractions generalized

25. Experimenting With Linear Graphs
    Filename: ØGRAFEXP
    High school level - too difficult for EMR

26. Facts Practice
    Filename: ØFACTS
    3rd grade reading level
        A. Covers addition, subtraction, multiplication, division
        B. Excellent - has all facts 1-10 and mixes for addition
        C. Same for subtraction, multiplication, division

27. Fraction Notation PMP
Filename: ØFNOTATION
3rd grade reading level

28. Fractions Basketball
Filename: ØDRIB
3rd grade reading level, math hard 5th and above
A. Can choose to use negative numbers
B. Uses unlike denominators
C. 20 practice shooting baskets by yourself
D. 20 play a game with a friend

29. Here are Some Hard Open Sentences, But They are Easy if You Can Find Two Secrets
Filename: ØQUADRATIC
Simple Reading, but 9th grade or above math algebra work

30. Heuristics I
Filename: ØHS1
Learning to add unlike denominators
3rd to 4th grade reading level

31. Heuristics II PMP
Filename: ØHS2
3rd grade reading level
Teaches reasons that fractions cannot be added without like denominators

32. Heuristics III PMP
Filename: ØHS3
3rd grade reading level
A. Counting money, changing 1 quarter to cents
B. Also adding and subtracting money
C. Excellent lesson

33. Heuristics IV PMP
Filename: ØHS4P
Practice and heuristics 4
A. Adding and subtracting with unlike denominators

34. Heuristics Review PMP
Filename: ØHSREV
3rd grade reading level
A. Reviews fractions with unlike denominators

35. High Wire PMP
Filename: ØMONKEY
4th grade reading level
A. Adding fractions with like and unlike denominators
B. PLATO hides the monkey (instructions here)
C. Play hide the monkey with a friend
D. You hide the monkey yourself

36. How to Use and Write Boxes and Hexes
Filename: ØBOXES
4th grade reading level - fairly simple
A. Learning to write a symbol sentence

37. Identities
Filename: ØIDENTITY
4th grade reading level
A. Creating sentences with symbols

38 Inequalities with Like Denominators
Filename: ØINEQ
4th to 5th grade reading and math
A. Excellent PMP
B. Inequalities with like denominators
C. Inequalities with unlike denominators
D. Checkup: Inequalities

39 Introduction to Multiplying Mixed Numbers PMP
Filename: ØFMINT
5th or 6th grade math
A. Excellent lesson

40. Lights PMP
Filename: ØLITES
High 3rd reading level, 4th or 5th grade math
A. Lights (lesson)
B. Checkup: Lights

41. Lights Equivalent Fractions
Filename: ØLITESEQ
4th reading level, 5th math
Very good lesson

42. Make-A Monster PMP
Filename: ØMONSTER
4th grade reading level
A. Make a monster
B. Make a monster with equivalent fractions
C. Make a monster with one cup (no instructions)
D. Hard for the LD child
E. Long wait for activity but cute idea

43. Making Up Open Sentences PMP
Filename: ØMAKEOPSEN
4th grade reading level, but instructions not clear
A. No direction given and no help access

44. Mixed Number Answer Format PMP
Filename: ØNAF
4th grade reading level
A. Help available

45. Mixed Number Multiplication Practice PMP
Filename: ØFMDRILL
4th grade reading level
A. Mixed number multiplication practice
B. Checkup: Mixed number multiplication
C. Help available to student

46. Mixed Number Notation PMP
Filename: ØNLINTROB
3rd grade reading level
A. Very short lessons
B. Help available and given

47. Mixed Numbers with Pizza PMP
Filename: ØPMIX
High 3rd grade reading level, checkup is 1st grade
Math level is 5th or 6th grade

48. Multiplication of Fractions PMP
Filename: ØFMULT
4th grade reading level
A. Help given on this lesson

49. Multiplication Practice, With Pictures PMP
Filename: ØPMPIX
4th grade reading level
A. Places you in levels as you master and complete a lesson

50. Now You're Going to Use True, False, and Open Sentences
Filename: ØTRUFALOP
4th reading level
A. Help available on this lesson

51. Number Line Introduction PMP
Filename: ØMLINTROD
4th grade reading level
A. Short lesson

52. Number Names for Today
Filename: ØDATES
4th grade reading lesson

53. Obstacle Course
Filename: ØOBS PMP

54. Paint Addition PMP
Filename: ØRECAD
3rd to 4th grade reading level
A. Paint addition: PLATO paints
B. Paint addition: You paint
C. Paint addition: Your choice
D. Checkup: Paint addition (fractions)

55. Paint and Compare PMP
Filename: ØRECCOMP
3rd to 4th grade reading level
A. Paint boxes to compare fractions, requires coloring before it accepts the answers
B. Slow activity

56. Paintings Library PMP
Filename: ØRECLIB
6th grade comprehension, complex tasks
A. Many computer options not controlled
B. Hard for LD child
C. Attempts fraction 1/2, 3/5, 6/8 - paints each a different way
D. Activity for gifted children

57. Patterns in Guess my Rule, Looking at the Differences
Filename: ØFINITEDIF
A. Must know large/small
B. Abstract patterns
C. Uses approximately 7th grade number format
D. Teaching activity is slow
E. 5th to 6th grade reading level

58. Pick a Tub PMP
Filename: ØTUBS
A. No explanation of procedures for fractions
B. Reducing fractions
C. No teaching
D. Graphics

59. Pinball
Filename: ØPINW
5th grade reading, high physical coordination necessary
A. Fast, timed game
B. Drill on +/-/X/divide
C. Last problems are timed and get faster during game
D. Includes mixed fractions, 3 tries per problem

60. Pizza PMP
Filename: ØPIZZA5
4 problems per level/ 4 levels
On screen reports that there are 46 levels

61. Pizza PMP
Filename: ØPIZZA1
3rd grade reading
A. Good easy demonstration of fractions
B. 4 levels
C. Uses both symbols and words (1 third)
D. Help not good, must know the term denominator
E. Graphics excellent

62. Pizza Common Denominator PMP
Filename: ØPOD
Same format as other pizzas

63. Pizza: Mixed Numbers Introduction PMP
Filename: ØPIZZA4
23 levels review of other pizza programs
Excellent format

64. Pizza: Cutter Stuck PMP
Filename: ØPIZZA2
5 levels
A. Mental math; must do in head
B. Fixed denominator, must reduce or combine
C. Confusing graphs

65. Pizza: 2 Pizzas for 3 Kids PMP
Filename: ØPIZZA3
9 levels, 1 exercise at each level
A. No instructions given but identical for other pizza games

66. The Postman Stories-Adding and Subtracting
Filename: ØPOST
4th to 5th grade reading all word problems
A. Uses math with checks and bill and bank balance sheet
B. Must be able to spell well
C. Fill in the blank reading and number sentences
D. Simple understanding of signed numbers

67. Putting Numbers Into Boxes When You Have More Than One of the Same Shapes (Rule for Substitution)
Filename: ØSUBSTITAT
High 3rd to 4th grade reading level
Help is given as miss one

68. Seabattle
Filename: ØBATTLESHI
A. Lesson in this strand based on the Madison project materials by Robert Davis
B. For a short game (3 ships)
C. For a long game (5 ships)
D. In this exercise involving coordinates on a graph, the student plays against PLATO using a guessing games type format. The student must be able to understand graph plotting in order to set the game up and to continue play beyond the initial moves.
E. The graphics are excellent and would be highly motivating for a middle school age student, very much like current tv video games in idea
F. Difficulty level hard for EMR students

69. Simplest Terms
Filename: ØSTERMS
3rd to 4th grade reading level
A. Simplest terms (lesson)
B. Checkup: Simplest terms

70. Skywriting PMP
Filename: ØSKY
A. A graphics exercise designed to enable the student to practice using signed numbers
B. + and - numbers used creatively but without grid or graph
C. Requires complete mastery of abstract plotting
D. Directionality could be a problem here with LD students as the "spider" and the "airplane" must be guided to move even when reversed or upsidedown on the screen

71. Solving Open Sentences
Filename: ØOPENSEN
4th grade reading level, about 5th/6th grade math
A. Student chooses a rule to solve
B. Student is given a rule to solve

72. Sort Equivalent Fractions PMP
Filename: ØSORTEQF
4th grade reading level, 5th/6th grade math
A. Sort equivalent fractions (lesson)
B. Checkup: Sort equivalent fractions

73. Sort Equivalent Mixed Numbers PMP
Filename: ØSORTEQM

74. Sort Equivalent Problems PMP
Filename: ØSORTAD

75. Sort Number Names With Decimals PMP
Filename: ØSORTD PMP

76. Sort Numbers by Form PMP
Filename: ØSORTF
Uses touch panel
Mixed whole and fractions, 4 levels

77. Space PORT
Filename: ØPORT
5th to 6th grade reading, long attention span. This game provides drill and practice in addition and subtraction. Students are given a number for the "in" gate of a landing spacecraft and must determine the "out" gate for the spacecraft by adding or subtracing whole numbers.
A. Mental subtractions skills necessary numbers 20 and below
B. Slow activity, good graphics
C. Slowly gets more difficult, long activity

78. Splash! PMP
Filename: ØPOGO
5th grade reading level
A. Uses a number line, fractions and negative numbers
B. 11 levels
C. Mental fractions conversion makes activity difficult
D. Encourages estimation
E. Confusing notations given
F. No explanation available

79. Sticks and Strings
Filename: ØRODS
This learning activity has the students construct fractions using sticks of 4 different lengths. Using a string the same length as a stick, the student folds the string into haves or thirds and measures off the appropriate fractions (1/2.2/2,3/2/1/3,2/3.3/3,4/3)
very simple reading level

80. Strategies for Listing Equivalent Sets PMP
Filename: ØSTRAD
Practice in adding and subtracting fraction and mixed numbers by having them use equivalence sets to find common denominators
A. Step by step equivalence teaching
B. Strategy for listing equivalent sets
C. Checking adding and subtracting with unlike denominators

81. Strategies for Multiplying Mixed Number PMP
Filename: ØFMSTRAT
34 levels, teaching activity, help given
Explains that there are many ways to multiply mixed numbers, then helps students find easy ways to solve problems that are provided.
Length: 30-45 minutes
Goals:
1. Introduce easy way to multiply mixed numbers
2. Provide practice multiplying mixed numbers
3. Provide practice multiplying mixed numbers

82. Subtraction With Borrowing and Addition and Subtraction PMP
Filename: ØPAD2
A. Subtraction with borrowing
B. Addition and subtraction practice with simplification and borrowing
C. Checkup: Addition and subtraction of mixed numbers with unlike denominators time: open-ended
3rd to 4th grade reading level, much like other pizza exercises

83. Target Practice PMP
Filename: ØROCKET
Uses signed numbers and fractions 8 levels
A. Like denominators
B. Unlike denominators
C. Practice in adding fractions and encourages checking answers by estimation

D. No explanation of errors
E. Time 20-30 minutes
F. Difficulty adjusted to student performance
G. Student fires rocket on number line to score bullseye

84. Tic Tac Toe
Filename: ØTTT
Elementary math, plotting on a graph
A. No reading necessary
B. Orientation difficult, especially for LD

85. TORPEDO PMP
Filename: ØSEA
5th to 6th grade reading level
A. Torpedo fractions
B. Torpedo with decimals
C. Whole number torpedo
D. Number lines changes with every exercise, confusing
E. Has timed games with 12 second response time, too short
F. Need excellent updown orientation, possibly confusing
G. Interterminal game; provides practice in using decimal numbers to estimate fractional distances on a number line

86. Try These: Equivalent Fractions PMP
Filename: ØTRYEQ
Mental fractions, 3 levels in each section
A. Equivalent fractions
B. Fraction and mixed numbers
C. Equivalent mixed numbers
D. High division ability for mental computation
E. Checkup: Equivalent fractions
F. Checkup equivalent mixed fractions 4 problems

87. Units PMP
Filename: ØFUNITS
3rd grade reading level
A. Introduces the fraction concepts
B. Short lessons
C. Fractions using pictures
D. Help available to student

88. Vocabulary: Whole Number Fractions, Mixed Numbers PMP
Filename: ØNLINTROC
5th grade reading, touch panel use
A. Short lessons

89. Welcome to Pizza
Filename: ØPIZZA PMP
Index to pizza series

90. Whole Number Operations Practice
Filename: ØOPS Test
Not a teaching activity and offers no help. Review of whole number operation. Uses a carrying procedure to help students with mental computation.